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DAMAGE PROBABILITIES FOR SMALL-CEP, LOW-YIELD, AIRBURST/GROUNDBURST ATTACKS AGAINST SELECTED PVN AND QVN POINT TARGETS

D. C. Kephart, et al RAND Corporation

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August 1975

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Damage Probabilities for Small-CEP, Low-Yield, Airburst/Groundburst Attacks Against Selected PVN and QVN Point Targets

D. C. Kephart and M. J. Parise

A Report prepared for

UNITED STATES AIR FORCE PROJECT RAND

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Presents computed tables showing the single-shot probability of damage to a target as a function of yield and CEP, for a weapon bursting either at ground level or at an altitude that approximately maximizes the probability of blast damage. The tables cover 28 P-type and 12 Q-type targets of current military interest. Additional spot calculations involving yields, CEPs, and vulnerability numbers not listed in this report can be made using Rand's circular slide rule calculator R-1380-PR. See also R-1168, R-1168/1. (PB)

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Damage Probabilities for Small-CEP, Low-Yield, Airburst/Groundburst Attacks Against Selected PVN and QVN Point Targets

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PREFACE

This report is a companion volume to Rand reports R-1168-PR and R-1168/1-PR, which together present tables of single-shot "optimal" airburst damage probabilities as a function of delivery CEP and yield for 150 selected P-type (PVN) and Q-type (QVN) military targets. It was prepared under Project RAND in response to requests by Air Force officers and agencies for additional computed tables estimating the outcomes of attacks using small CEPs and small nuclear weapon yields, both airburst and groundburst, against certain overpressure-sensitive PVN point targets and dynamic-pressure-sensitive QVN point targets.

The damage probability tables given here cover 28 PVNs and 12 QVNs of current military interest. Additional spot calculations involving yields, CEPs, and vulnerability numbers not listed here can be made using Rand's circular slide rule calculator R-1380-PR, which is available to users of this report.

This work was conducted under the Rand project entitled "Future Strategic Aerospace Force Requirements."

^{*}R-1168-PR, Some Aids for Estimating Damage Probabilities in Attacks Against Targets with P and Q Vulnerability Numbers, D. C. Kephert, March 1973; R-1168/1-PR, Some Aids for Estimating Damage Frobabilities in Attacks Against Targets with F and Q Vulnerability Numbers: Supplementary Tables for Point Targets, D. C. Kephert, November 1973; R-1380-PR, Damage Probability Computer for Point Targets with P and Q Vulnerability Numbers, D. C. Kephert, February 1974.

DAMAGE PROBABILITIES FOR SMALL-CEP, LOW-YIELD, AIRBURST/GROUNDBURS: ATTACKS AGAINST SELECTED PVN AND QVN POINT TARGETS

This report presents computed tables showing single-shot probability of damage (PD) to a point target as a function of yield and CEP, for a weapon bursting either at ground level or at an altitude that approximately maximizes the probability of blast damage, for a selection of PVN and QVN vulnerability numbers of current military interest. Damage probabilities are tabulated for yields in steps from 1 ton to 70 KT, with CEPs in steps from 0 to 600 ft. Definitions, assumptions, and mathematical bases for the damage tables are as detailed in Rand report R-1168-PR and in Physical Vulnerability Handbook-Nuclear Weapons (U), Defense Intelligence Agency, AF-550-1-2-69-INT, 1 June 1969 (Confidential).

The quantities listed in the computer printout PD tables are identified below:

- VN = vulnerability number; arbitrary classification of a
 target's susceptibility to blast damage (as defined in
 R-1168-PR and in the DIA's Physical Vulnerability Hand book--Nuclear Weapons).
- KT = warhead yield, kilotons.
- Adj VN = adjusted VN, to account for yield-dependent damage response.

 - HOB weapon height of burst, ft (airburst values for HOB > 0 are associated with "maximum" probability of damage).
 - WR = weapon radius, ft.
 - CEP = circular probable error weapon delivery accuracy, ft.
 - PD = single-shot probability of damage.

For target VNs and yield-CEP combinations not listed here or in R-1168-PR, an interactive computing program is available (as described

in R-1168-PR) for calculating additional PD tables via remote interactive coupling to Rand's JOSS® computer. The computing program also calculates discrete sets of airburst and groundburst damage probabilities for both point targets and circular area targets with an offset aim point option for any yield-CEP combination, for both PVNs and QVNs.

For those wishing to translate to other computing languages a listing of the JOSS program is included in this report as Appendix A, and a summary of the JOSS language is presented as Appendix B. Attention is invited to parts 37 and 38 in the program where the equations fitting weapon radius to the adjusted vulnerability number are revised slightly to smooth out minor discontinuities associated with those listed in R-1168-PR.

The 1974 revisions to DIA's Physical Vulnerability Handbook--Nuclear Neapons do not affect the results for PVNs (sigma-20) and QVNs (sigma-30) given here and in the previous Rand publications. Concerning the accuracy of results--while the calculated damage probabilities are printed in three significant figures as an aid to curve-plotting and to show incremental trends, it should be recognized that actual outcomes might be greatly perturbed, perhaps as much as 25 percent, by uncertainties in bomb yield, delivery accuracy, height-of-burst, target location, target response, and target vulnerability number. These uncertainties, which are not accounted for here, may not ever be predictable, with high confidence, in advance of a conflict involving nuclear weapons.

The vilnerability numbers for which PD tables are presented, either here, or in R-1168-PR, or in R-1168/1-PR, are indexed on the following page. In R-1168-PR and R-1168/1-PR the PD tables are for airbursting on point targets with yields varying from 20 KT to 12 MT or 25 MT, with CEPs varying from 200 ft or 400 ft to 10,000 ft. In this report the PD tables are for both airbursting and groundbursting on point targets with yields varying from 1 ton to 70 KT and with CEPs varying from 0 to 600 ft.

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INDICES OF DAMAGE PROBABILITY TABLES

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.10 37.5 10%7	8	56.	950 1721 252 292	200 144 69 055 039	072 022 017 019	.10 1047 1047 38 35	f. :	£ 8	24. C.	162 162 162 163 163 163 163 163 163 163 163 163 163	5 5 5 5 E	
.07 38.3 1199 0	£	8 6.	964 781 616 359	.151 .109 .062 .9%0	021 013 013 013 007	FC	Ę.	£ £	5.4.6.4.4.4.4.4.4.4.4.4.4.4.4.4.4.4.4.4.	1166 117 245 245		
.05 39.0 1377 5	K.	8. 59. 85. 98.	.819 .641 .491 .266 .161	276 043 229	014 011 009 007 005	22.65	<u>t :</u>	5. E. S. F. S. P.				
.020 41.3 2101 0	Ľ	92.	.533 .356 .249 .120	.032 .032 .019 .012	906 605 904 903	.027 7191 7191 34	ů.	5.5	6. E. C.	6. 6. C.		
.010 43.3 3012 0	E.	999 939 759 569	.198 .198 .133 .962	003 009 006	003 002 002 001	1	1,1	5 7 7 5		618 618 618 618 618 618		
.007 4.43 36.73 19	£:	537	23.000	916 905 905 905 905	902 902 901 901	EAR HE	h!	6 1 W F	6.	21.6 20.0 20.0 20.0 20.0 20.0		
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.001 50.8 11891	E1	54.26	912	. 991 . 991		** IT ** V T F	n.			18.		
	8	p v 51 21 55	និងនេន	128 200 250 350 350	350 450 500 500 600	Party of the Control	<u>ը</u> ՝	· w r w r	E T TO SET	50 C C C C C C C C C C C C C C C C C C C	t c fre co	

33P4

Grou	ınd-burst		Air-burst						
70.00 32.1 367 367 6	86. 86.	928	32.1 387 397 946	2		.999 .997	978 953 124 137		
50.06 6.15 6.15 6.15 6.15 7.10	.993 789. 789.	.930 .883 .758 .758	50,00 7 32,3 *03 351 651	£		998	95- 919 878 873 715		
20.00 4 5 0 2 4 5 0 2 4 5 0	£ % € % ₹	£ 2 2 2 2 5	26.00 5 33.0 250 250 598	£		999 997 951 951	673 673 673		
10.00 33.7 33.7 523 523 613 613	86. 178. 178. 178.	282	10,00 2 33,7 523 197 453	£	86	995 985 785 355	555 555 565 566 520 319		
7,000 J 36,1 565 35,6 35,6 7	* * * * * * * * * * * * * * * * * * *	21 × 22 × 22 × 23 × 24 × 24 × 24 × 24 × 24	7,000 1 34.1 565 167 392	£	995	948 969 988 776	356 396 337 250		
5.000 ;	* * * * * * * * * *	276 276 276 271 231	5,000 7 34,6 613 14,7 340	£	999	£ 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	382 319 319 268 196		
2.000	8 8 8 8 8 8 1 1 1 2 1 2 1 2 1 2 1 2 1 2	215 173 173 186 186 2115	2,000 5 36,0 798 102 228	2	966	758 758 568 371	250 198 151 133 054		
1.006 2 37.4 101: 0 156	999 1999 1772 1772 1893 1893	721 999 979 859 859	1,000 2 37,4 1719 77 166	£	991	571 547 359 257 186	111 111 00 00 00 00 00 00 00 00 00 00 00		
	86. 67. 67. 67. 67. 67. 67. 67. 67.	050 050 7.40 050	.700 1 18.1 117.4 66 14.0	£	£ 2 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	.556 .437 .284 .192 .192	.081 .081 .053		
25.00 25.00	.936 .979 .979 .938 .756 .566 .320 .320	070 0.05* 0.035 0.035	500 38.9 1356 58 119	8	18 8 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	2 K 2 E 2 E	.059 .059 .038		
2100	284 284 284 284 284 192 192 198 198 198 198 198 198 198 198 198 198	.021 .021 .013	25. 21.3 2190 39	PD 999	650 660 670 670 670 670 670 670 670 670 67	216 1156 1069 1089	20. 21. 21. 21. 21. 21.		
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70.	25. 10. 10. 10. 10. 10. 10. 10. 10. 10. 10	200 200 200 200 200		75 999 990	721 529 368 200 115	.055 .055 .031	000 000 200 200 200		
60. 52. 52. 52. 52. 52. 52. 52. 52. 52. 52	256 256 161 161 162 163 163 163 163 163 163 163 163 163 163	90.000		E 5.58	232	.039 .039 .022 .010	907		
.020 28.6.6 7883 7883 0 21 21 89 89 89 89 89 89 86 86 86 86 86 86 86 86 86 86 86 86 86	.776 .112 .052 .023 .029 .013 .007	902 200 100 100 100 100 100 100 100 100 1		E \$455	1.1.1 1.1.2.9 1.0.56	011 011 003 003 005	.003 .002 .001 .001		
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.007 52.22 112 d	.057 .037 .037 .009 .002 .002 .002	.00.	.007 52.2 10 12	952 953 949 217	45. 81. 81. 81. 81.	93.2 56.0	.001 001		
SS. 200.	070 070 072 012 0012 003 003 0013 0011	6	53.4 53.4	e were	222	9 5 5 5 E	£.		
56.7 1.002 1	000 000 000 000 000 000 000		£. 73 7. 10 10	70 593 111 171 058	926 915 916 97	93.			
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	83 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	350 4 4 50 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	F. See See See See See See See See See Se	# c s o s o s	ខ្លួនសន្តិ	125 150 299 250 250	359 600 600 600		

Ground-burst							Ai	r-bur	st			
	8.5 2.5 2.5 3.0	2			£	£ \$ \$ \$ \$ \$	2.00 40.00 1.00 1.00 1.00 1.00 1.00 1.00	2			# ₽	5555
	85,408	2			335	22.23.25	50.00 11.0 375 375	2			6.69	5 2 6 2 2
	8 6 9 0 4	2			\$ 6.0 \$ 7.0 \$ 4.0 \$ 4.0	537	20.00 s 33.0 250 250 598	2			9 6 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	925 74.6 677 671
	8 . 2 . 5	2		.999	98. 986. 986. 170	331	17.00 2 34.9 639 183	2		*6		28.7
	8.5 8.5 8.5 8.5 8.5 8.5 8.5	٤		966.			7.007 75.8 765 136	ē.				
	5.000 7.000 10.00 20.00 3.4.6 25.8 30.8 33.0 3. 916 785 638 460 0 0 0 0 0 275 325 387 544	٤		99.		.33 273 273 136 136	36. 134. 234.	2				232
		2		222	.676 .372 .372 .372	1110000	2,000 5, 37,6 4543 83	2			724 603 416 295 217	
	1.000 2. 2347 2347 115	2			. 202 . 202 . 203 . 203 . 096		1.000 2 41.9 2747 66	2			132.55	
	.700 1 2929 2929 35	£	\$	11151	237	0000	43.2 2929 57		.60		25. 25. 25. 25. 27.	955 955 973 973
	.500 .4.4.9 .00 .00 .00 .00 .00 .00 .00 .00 .00	£	996.	.964 .781 .781 .341	237 202 204 740	.027 .027 .017		2	•:-		251 191 101 101 101 101 101	
	8.50	2	:: 8	552	.095 .039 .025	6000	5.73 6.839 3.30 5.00	2	949	8.79 8.79 25.9	104 173 042 027	911 931 907 905
	5.5 5.0 5.0 5.0 5.0	2	925	. 355 . 249 . 121	0.032	900	5. % *	90	413	355 266 179 275	975	205 205 205 205
	 	٤	. 9.1 8.4 8.7 8.7 8.7	260	.031 .022 .012 .006	900000	51.3 21.3 22	2	475 860 875	273		203
	\$2.5 \$2.5 0	2	.999 .740 .543	.126 .058 .033	.00. 00. 00. 00. 00.	5.86.200	25.5 23.5 23	C.	. 999 938 . 756	319 172 172 061	023 023 006 006	993
	.020 55.8 0	5	.971 .673 .607	0.072 0.022 0.022	9888	9000	.520 55.8 13	2	.972 .691 .414 .264	173 075 072 072	2003 2003 2003 2003	201
	5.00	2	. 219 . 219 . 131	.022 .022 .036	96566		. 310 58.4 10	2	420 220 270	061 022 010	203 203 201 201	
	59.7	٤	154	25200	993		59.7	2	309	902	.002 .002 .001	
	.005 60.4 0	2	.226 .109	.029 .010 .020 .000	.001		.005 67.9	6	.615 .223 .107	016 016 010 005	.007	
	.002	9	.089 .041	90.00.00.00.00.00.00.00.00.00.00.00.00.0	.003		.002 64.5	5	297 086 019	900	.001	
	.001	2	.043 .019 .019	992			66.9	ć.	.147 .047 .019	995		
3380	Adj VK pai Hob	CEP	2555	30 80 100	125 150 200 250 300	350 400 500 500 600	A41 Vu 291 1108 1108	d T.	10 15 20	6 4 5 5 5 6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	125 150 250 300	350 450 450 530 530

35PI

Ground-burst Air-burst 8;;°\$ e 8.3.3 ° 5 5. 5. 5. E 3 20 27.3 2 2 2 2 2 8 8.25 . 5 13 14 15 E ## #FF1E 3187E Sta grade contr 15.00 5.2 86.2 1.0 1.0 1.0 100 mm 10 71.10 71 15.00 15 25.25. 27.25. 27.25. 27.25. 27.25. 20.00. 20

10.00 10

	Gro	und-bur	st			Air	-burs	t	
70.00 35.3 700 11.7	£	Į		206 786 727 601	10.00 15.3 17.6 14.1	g.		****	
8.5 7.2 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0	e	5.5	.	11.	35.7 758 30.2 30.2	£		992	
8.5. 2.5. 1.0. 1.1.	2	***	.922 .029	. 530 . 530 . 390 . 293	20.00 1 17.0 954 212	Ē	66.	25.25.5	. 575 . 575 . 497 . 430
26.2	2		525	350 350 230 230 171	10.00 3 39.7 1184 161 338	£	95.	979 976 986 986 988	373 373 316 276 175
8 2 4 0 %	2	25.5	437	223	34.9 1346 139 287	5	976. 689.	1625.S	293 293 241 241 145
3,000 T 39.6 227	2	88.6 88.8 88.8 88.8 88.8 88.8 88.8 88.8	.421 .320	197 160 132 094	34.6 1533 122 245	<u>a</u> .	990	900 1900 1864 1359	.281 .225 .183 .151
1.000 2.000 8 83.7 41.8 3246 2292 0 0	2	2000 2000 2000 2000 2000 2000 2000 200	207	.013 .03 .05 .05 .05	2.000 5 41.8 2292 84 156	2	45.55	233	128 100 060 065 065
2.7.5 2.7.5 2.0.0 2.0.0 2.0.0	2 \$	66 50 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	156	036	1.000 2 43.7 3246 63 109	e e	: # # # # # # # # # # # # # # # # # # #	.394 .301 .185 .54	065 050 040 040 033
3932 8 0 1	2 :	27.27 27.27 27.27 27.27 27.27	0.00 0.00 0.00	023 025 020 020	.700 1 44.8 1432 54 91	g .	945	220	045 035 028 023
.500 .5.8 .743 .77	e	. 258 . 258 . 295 . 202	90.00	029	.500 #5.9 #743 #7	99 \$96.	. 875 . 757 . 757 . 889	952	.025 .025 .016
5 - 5 ° 5	5	211 211 126 126 126	021	000.000	48.3 4134 32	99.	. 575 . 575 . 130 . 135	.036 .036 .036 .016	012 003 004 006 006
3.5	5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	107	200	900000	51.1 51.1 24 31	98.	115. 115. 111. 186.	555	90.00
.07 \$2.3 82.3	515 160 1512	. 233 . 233 . 074 . 042	000	003	.07 52.3 21 26	5 6.50	24. 27. 27. 20. 20. 20. 20. 20. 20. 20. 20. 20. 20	.020 .020 .011 .001	902
53.5 21.5	5 5 11 1 1 5 S	0000	688	907	1.5 1.5 21	.998 .113 .715	1175	900.000.000	903
.020 56.8 0	5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	11000	862	901	.020 56.8 13	180 180 180 180 180 180	020	56.66.	100.
0.00 0.00 0.00 0.00 0.00	2 200	200 000 000 000 000 000	888		.013 10.83 119	.525 .325 .198	86.00 000 000 000 000	992	
.007 .008 	27.23	200 200 200 200 200	00.		50.5 80.5	705 .280 .138	000 000 000 000 000 000	931	
.005 6.1.8 0	25.03.05.05.05.05.05.05.05.05.05.05.05.05.05.	900	.00		.005 61.8 7	24 .202 .096 .096	.003 .003 .004	19. 19. 19. 19. 19. 19. 19. 19. 19. 19.	
.002 65.1	70 037 037	003			.002 65.1	64 750. 770. 650.	. 203 . 203 . 301	100.	
. 001 6.7.6 0	5 110.00 100.00 100.00	. 002 . 002 . 001			.001 67.8	135 0.036 0.06	.004 .001 .001		
Adj ve	50 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	30 50 100 123	300	1360 160 160 160 160 160 160	KT Adj ve jst HOP	CEP 0 5 10 15	35 50 75 175	125 150 270 250 170	6 5 4 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5

37P7

Ground-burst							Air-burst					
8	3°2	2			26. 28. 28.	.915 .862 .802 .739	70.00 36.9 64.9 34.9 803	ត្ត		76°. 989 116.	941 998 7447 576	
	: 203	2				.858 .766 .716 .647 .523	50.00 1 15.4 711 376 694	2		93		
8.		2		6.	980	. 530 . 530 . 390 . 293	27.00 7.0 954 212 461	2	ž.	26.2.4.5.	. 575 . 497 . 497	
9.0		2			.962 .915 .781 .638	. 417 342 283 237 172	10.00 14.5 1248 159 312	G.	8.5	60. 673.		
8	305	2		999	. 829 . 654 . 503	201 201 167	7.000 19.3 1456 137 273	<u>a</u>	996.	438 438 438 438	.347 .280 .230 .191	
	2,002	٤		998	734 734 103 103	.234 .150 .150	5.000 40.2 1700 1119 236	a a	6.00	er. Ser. Ser.	1711	
2.00	270	2		999 993 976 862	.548 .276 .188	.063 .063 .051	2.000 42.7 2708 81	2	9995	.570 .469 .775 .715 .152	150 150 150 150	
90		2	£.	989	328 243 147 097	.033 .033 .035	1.000 44.8 1391 51	ă .		.157 .267 .167 .187	.057 .035 .035 .035	
8.		5	186.	970 .786 .786 .521	12.58.9	.027 .021 .021 .012	.700 115.0 4.015 52 94	g .	614 614 618 558 474	191	6.00 6.00 6.00 6.00 6.00	
8.	670	2	.99 4	. 610 . 673 . 407	176 126 073 098	.015	.500 47.1 6077 45	e.	122.25	151. 181. 180. 180. 180.	.027 .016 .016 .013	
8.5		2	.997	. 682 . 489 . 355 . 180	0.000	9000	.20 50.2 31	5 £ £ 5	£3555	\$50.00 \$10.00 \$10.00 \$10.00	000 000 000 000 000 000	
01.	, o ,	2	376. 183	.431 .276 .188 .089	.00. .00. .00.	96.50	.10 \$2.6 23 28	5 552	44.00	900	\$00. \$00. \$00.	
.0.	. 02	£	939	.198 .198 .132 .061	936	.003 .001 .001	55.53 88 88	70 99 99 99 99 99 99 99 99 99 99 99 99 99	204	000000000000000000000000000000000000000	993	
8.	: 05	2	8.0.3 8.0.3 8.0.3	.236 .043 .043	.016 .006 .006 .004	.002 .001 .001	.05 55.1 18 19	d 6.00	24.00.03	000. 000. 000. 000.	303	
020		2	.936 .567 .320	.034 .035 .035	005	.001	55 51	939	\$200 \$100 \$100 \$100	200	.001	
.010	• • •	9	.166 .131 .098	.026 .015 .007	903		.010 6.03 9	7	926.00	900		
100		2	.239 .115	.017 .011 .005	.001		.007 62.2 8	F	61166	100.		
500		2	. 172 . 0 . 172 . 0 . 0 . 0 . 0 . 0 . 0 . 0 . 0 . 0 . 0	.012 .008 .003	.001		,775 63.4 7	a girig	21666	90.		
.00	• • •	9	.030 .030 .017	00.00.00.00.00.00.00.00.00.00.00.00.00.			\$ 500 6,49 5	72.25 .063 .028	55055			
.001		S.	110.	002			63.3 63.3	.029 .0110 .013	200			
E E	Pat Pat HOS	9	32220	30 50 75 100	125 150 200 250 350	350 400 600 800 900	Adi ya psi HOB	00 cm	6 5 6 7 0	125 150 200 250 300	150 450 450 560 560	

38PI

		Ground-burst							Air-burst				
	70.00 37.8 1104 626	ã			999	. 776 . 702 . 632	70,00 37,9 1104 112 564	G.			994	.875 .809 .740 .671	
	37.4	£			.999 .996 .933	787 704 624 554	11 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	a.		*	997	741 665 594 472	
	20.00 38.0 11.65	ę		€66.	\$ 60.00	583 426 359	20,70 39,0 1165 296 432	Ę.		966.	.313 985 923 830 724	. 531 . 531 . 455 . 391	
	10.00 38.1 1176 0	£		988	.965 .921 .791 .650	.428 .351 .291 .244	1176	£		.999	.937 .821 .686 .586	.461 .381 .717 .267	
	7.000 38.2 1196 0	2		996.	.938 .715 .566	.356 .288 .237 .197	14.7 14.7 11.3 14.3	6		.997 446.	951 896 749 502	386 314 259 216	
	5.000 38.3 1219 0 252	2		.992 .992	.400 .539 .639	.236 .237 .193 .160	127 127 127 127 127	5		.994	. 672 . 672 . 522	.321 .258 .211 .176	
	2.000 38.7 1292 0	8		.999 .995 .955	.735 .614 .425 .303	133 107 088	18.7 18.7 128? 128?	£		399 996 986 980	764 64: 455 326 242	146 117 117 096	
	1370	g.		.994 .994 .717	.570 .231 .231	.084 .084 .067 .055	1370	5		999 996 994 186	.599 .477 .312 .215	.091 .073 .059	
	.700 14.2 1420 121	2		.997 .985 .953 .609	.461 .353 .220 .148	079 061 049 040	10.73 14.20 54 131	δ.		.998 .968 .935	.510 .796 .251 .170	.04: .071 .057 .046	
	39.4	£		.971 .920 .717	.385 .290 .177 .116	062	17.00 14.74 14.74 11.5	5		.996 .981 .765 .765		.036 .036 .044 .036	
	.24 40.1 1672 0 75	8	966	.961 .754 .754 .985	.219 .093 .061	.032 .924 .019 .016	.20 40.1 1672 41	<u>a</u>	766.	973 102 777 533	248 191 707 770	.036 .028 .028 .019	
	.10 40.8 1890 0	Q	986.	. 572 . 574 . 574 . 201	.016 .036 .036	014	.17 47.8 1A90 32 62	PD	.997	.307 .575 .363 .283	153 116 963 941	.016 .016 .013 .010	
	. 07 2035 005 50	g 66.	991	.809 .628 .478 .258	.073 .073 .027	.014 .031 .004	2035 2035 28 28 53	£	.974	845 674 524 249 176	.083 .048 .031	016 017 010 010 010	
	.05 2199 0	04 866.	1926.	. 726 . 534 . 393 . 203 . 121	.073 .036 .032 .021	00. 00. 00. 00. 00. 00.	25. 25. 25. 25. 25. 34.	6.	947 94.	.590 .434 .229	790 036 036 036	012 003 003 007 000 000	
	.020 43.0 2828 0	PD .982	.736	100 100 100 058	.036 .026 .015 .009	903 903 903	.320 .6.64 .928 17	6.	388 311	.507 .335 .232 .112	242 230 110 110	208 209 203 203	
	.010 44.3 3579 0	.998		. 293 . 179 . 055	020	.003 .002 .002 .002	.010 .44.3 1571 13	á i	7.57 5.59	171 178 133 067	073 0716 000 106 106	.203 .207 .202 .201	
	.007 45.0 4102 0	.995 .857	.612	.087 .087 .040	.015 .006 .006 .001	.003 .003 .003 .003	12. 12. 12. 12. 12.	ria ?	541 644 757	244 147 007 0065	0116 0111 003 003	202 702 301 901	
	.005 45.8 4717 0	.987	333	.099 .065 .029	.007 .007 .003	.001 .001 .001	2005 44.34 4717 133 16	<u>.</u>	.519 .519 .351	19% 170 170 1932	.008 .005 .003	000 100 100 110 100	
	.002 48.1 7222 0	.894 774.	.155	013 027 012 013	903	• 001	44.11 44.11 7222 7222	5	275 275 167	515 515 505	203 203 203 201 201	10t.	
E	.001 50.1 0378 7	.704 .280	.138	037 021 001 006	.001		11.00 10.00 10.00	2	2.2. 2.2. 7.2. 6.3. 6.3.	.33 .327 .324 .306	. 202 . 202 . 301		
38P1	Adj va pat 10 HOB	CEP 0 5 5	20 20	2,000	125 150 200 250 100	350 400 600 500 600	A41, 42, 42, 43, 43, 43, 43, 43, 43, 43, 43, 43, 43	e il c	15 20 20	25. C. 2. E.	125 153 753 753 300	450 450 450 450 450	

38P4

Gro	und-burst		Air-burst					
75, 35 37, 1 96.8 0 652 70	.999 .998 .997 .925 .936	. 728 . 659 . 536 . 00 . 07 . 00 . 499	2 537		25.8 25.8 25.8 25.8 25.8 25.8 25.8 25.8			
50.00 7 37.3 1003 576 100	£ 8 8 5 8 8 8 8	55.00 50.00 1.00 1.00 1.00	41 G		986. 386. 200. 200. 200. 200. 200. 200. 200. 20			
20,00 St. 118.5 118.5 P.0	8. 9. 9. 9. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6.	.420 .359 .268 .268 .38.0		86.	8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8			
10.00 2 38.7 1 1302 5 312 PD	986. 986. 987. 773. 703.	10.00 19.00 19.00	159 327 PD	066°	959 976 976 976 976 976 976 976 976 976 97			
7.000 1 39.1 1407 262 PD		120 170 1700 181		.996 .978	777 777 762 762 763 763 763 763 764 764 764 764 764 764 764 764 764 764			
5,000 7 39.6 1525 228 228	. 999 . 985 . 938 . 938 . 757 . 567 . 367 . 378 . 320	1132 1132 1132 133 5,000 :	3 ¥ 5	86.00 86.00 86.00	. 399 . 901 . 500 . 500 . 500 . 500 . 163 . 103			
2,000 5 41,0 1985 153 PD	.996 .996 .996 .995 .764 .818 .896 .326 .123	2.000 1985 1985		. 398 . 994 . 804	555 465 195 195 195 195 195 195 195 195 195 19			
1,000 2 42,4 2536 0 112	.996 .938 .777 .557 .857 .818 .313 .193 .193 .092	25.5 25.6 25.6 25.6 25.6 25.6	f5 f5	1875. 1875. 1875.	103 103 103 103 103 103 103 103 103 103			
.700 1 2921 2921 95	. 986 . 986 . 989 . 989 . 989 . 989 . 989 . 989 . 989 . 980	. 036 . 025 . 025 . 706 . 706	£ 5	5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5	.353 .264 .167 .075 .075 .083 .083 .019			
	2772 2977 2977 2977 2977 2979 2979 2979	.022 .012 .012 .012 .539	2 % E	979 921 921 579 579	272 1199 1119 073 073 174 073 073 073 073 073 073 073 073 073 073			
.20 .20 5226 0 51 51 PD	. 110 . 078 . 078 . 078 . 078	. 20 . 20 . 20 . 20 . 20 . 30 . 30 . 30 . 30 . 30 . 30 . 30 . 3	AA g	945 945 945 945 1945 1945	120 120 120 120 120 120 120 130 130 130 130 130 130 130 130 130 13			
.10 7565 36 36 PD PD		900 900 900 10 10 10 10 10 10 10 10 10 10 10 10 1	P3 88 25	946 950 976 976 153 157 157	.056 .024 .015 .011 .016 .006 .005			
.07 3261 30 30 PD PD	215 215 215 216 200 200 201 201 200 200	.003 .003 .002 .003 .03 .03	P 312	230 230 230 230 230 230	.003 .003 .003			
20.5 1 20.5 1 20.5 1 20.999		.002 .002 .002 .001 .005	26 26 FD -999	653 653 653 751 751 650 650	000 000 000 000 000 000 000 000 000			
122 53.5 0 15 PU 761	.003 .003 .016 .016 .016 .016 .007 .003	.001 .001 .003 .027 .727 .53.6	13 16 17	14.5 13.5 13.5 14.9 10.0 10.0 10.0 10.0 10.0 10.0 10.0 10	001 001 001 001 001 001			
2315 56.0 0 10 PD 913 511	280 280 340 340 500 500 500 100 100 100	56.3	on and and and and and and and and and an	.513 .245 .174 .047 .047	985 991 991 991			
27.2 0 0 0 9 0 9 0 9 0 9 0 9 0 9 0 9 0 9 0 9	202 203 203 203 203 203 203 203 203 203	57.2	9 9 P.D. P.D. 9	393 121 121 122 123 123 123 123 123 123 12	201			
7 7 PD PD - 292		.065 58.4	e or 127.	.039 .039 .039 .039	.932 .942 .991			
61.7 61.7 8390 1120	. 001 . 001 . 001 . 001	.392 61.7	2 E 6	.014 .034 .014 .008 .002	. 341 . 341			
5-4-5-01 64-2-2-09 90-2-20-9	.017 .027 .004 .002 .003	.051	4 E GF C	.055 .018 .018 .036 .008 .011				
AA) VE TAN	20 10 10 10 10 10 10 10 10 10 10 10 10 10	500 500 600 600 7.14 7.14	E H H	10 15 20 20 20 20 10 10	125 136 250 250 350 430 430 430 630 630			

		Grou	ınd-b	urst		Air-burst					
95.9 15.9 0	: :	2		::£:	. 334 . 768 . 768 . 580	70.00 35.3 77. 335 752	2		6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6	55.55	
6.00		2		\$ 6 5 5 E	679	50.00 3 35.4 354 294 751	<u>Q</u>		\$ 5.00 \$	728 727 535	
26.06 28.0 28.0	ş £	2	•	6666	. 5 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	20.00 11.65 206 206	<u>a</u>	•	625	.531 .531 .331 .391	
10.00 10.00 10.00	= =	3	5 5	\$ 57.2 E	265 243 203 146	17.00 17.50 14.5 154	ē	186.	25. 215. 525. 535.	275 275 275 163	
74.00	? :	2	565		222 191 149 107	1749	G.	66.	. 1913 513 513 513 513 513	313 251 205 170 122	
.000 7.13 2045 0		2		. 805 . 365 . 365	.210 .156 .134 .110	5.000 ' 41.2 2040 116	£		347 547 305	1138 1152 1155 1175	
2.000 \$ 43.7 3249	3 1	2	990	.307 .393 .249 .168	032	2,000 13,7 3249 79 139	eg .	299 299 279 269	.546 .23 .275 .197	171. 070. 181. 181.	
1.000 2 45.8 4789 0		:	.985 .937 .603.	.297 .219 .086	.028 .029 .029	1,000 45,8 4789 59	eg .	0.00 4.00 5.00 5.00 5.00 5.00 5.00 5.00	.323 .144 .095	039 039 039 025 710	
. 700			967.4	.092 .092 .060	.031 .024 .019 .015	.700 47.0 5899 51 78	2d 66.	968 .889 .777 .511	173 173 100 1046	926	
22.20	3 ;		. 912 . 775 . 631 . 371	.065 .085 .030	.022 .017 .013 .013	.500 48.1 7274 44 65	PD .948	.926 .799 .660 .396	.122 .071 .071 .071 .032	.024 .018 .012	
51.2	= =		641 450 322 161 095	0.025	9000	.20 51.2 30 39	PD .997	.464 .338 .170	.046 .026 .017	000 000 000 000 000 000	
	* :		169	030 021 007 0 5	903	.10 53.6 23	PD 970	175 175 048	.031 .021 .034 .035	904 903 903 901	
6.50	≈ :	525	.290 .117 .055	0000	.002 .002 .007 .001	20 20 20	PD .998 .925 .728	.298 .182 .035	.021 .003 .003 .005	003	
56.1	= :		. 212 . 126 . 083 . 030	000	001	.05 56.1 17	PD 995 850 602	.129 .085	010 000 000 000 000	001	
59.6	= :	. 325 . 325 . 17	0031	0000	.001	.020 59.4 11	90 -920 -524 -289	031	. 005 . 002 . 003 . 001	• วดร	
.010 61.9	۲ ۾	157.3	.023 .023 .005	002		.010 61.1	PD .723 .29% .1%5 .08\$.039 .038 .038 .006	302 301 301		
63.2	•	. \$99 . 215 . 153	015	.002		.077 5.1.2	9 8 8 9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	003	.002 .001 .001		
66.0	٠ (2 2 3 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	.019 .001 .003	.001		. 2005 64.44 7	PD61	.010 .010 .005 .001	.001 100		
.002	•		.007			57.3 57.3 5	201 .201 .055 .025	000 000 000 000 000			
, 3.5.		.028 .028 .0012	.003			10°67 50°3	.097 .025 .011	.201			
38P7 XT X Adi VN 70 Pst HOB	% {	2 2 2 2 2 0 2 5	30 50 50 10 10 10 10	125 150 200 250 300	350 450 500 500 500 500 500 500	KT A41 VN ps.1 HOB	20 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	55. 57. 57. 57.	125 159 200 350	310 400 450 500 500	

38P8

			Grou	ınd-b	urst	Air-burst						
	70.00 35.3 701 0	2			.999 .995 .980	906 850 723 602	70.00 35.3 701 343	2			999 799 988 799	.933 .833 .774 .658
	36.08 36.0 7.80 0.0	2			998 998 958 908	942 769 628 528	50.00 36.0 790 299 565	£			999 997 971	878 .813 .757 .553
	20.00 50.00 38.0 36.0 1145 790 0 0	£		.998	9779. 9779. 9008. 9009.	.583 .494 .420 .359	29,00 38,0 1145 294 432	5		966*	993 923 923 830	.531 .531 .455 .391
	10.00 34.8 1597 c	£		966. 979.	937 872 713 563	286 286 235 196 141	10,00 39,8 1587 152 305	ë.		.997 386	955 903 760 614	396 373 267 223 162
	7,000 2,0,8 1904 236	G.		66. 886.	.973 .779 .592 .445	265 171 172 193	7,000 40,8 1904 131 253	2		.999 .992	962 819 646 379	238 238 194 161 115
	5,000 *1.8 2279	£		996. 9970.		197 155 103 103	5,000 #1,8 2279 213 212	£		.998 .979	.822 .71* .521 .392 .287	122 175 175 117 117 117
	2,000 2,000 380 0	£		.998 .986 .956 .802	361 228 152 152 169	.063 .050 .050	2,000 18,6 130 130	PD		.998 .997 .967 .932	.566 .393 .248 .158	940 970 956 955 732
	1,000 1,600 5841 0	£	986	.978 .917 .829 .562	.267 .195 .116 .076	6.00	1,000 26.4 57.	£:	966	.983 .931 .593	.286 .212 .225 .083	043 033 027 922 915
	7283	£.	.995 .393	944 784 786 280	.191 .138 .080 .052	027 026 046 043	72.53 72.39 55.77 73.39	Ð	. 993 595	88. 13. 13. 13. 13. 13. 13. 13. 13. 13. 13	206 1149 087 057	029 023 918 015
	.590 49.3 3008 n	8.	.997	. 205 . 205	.137 .098 .056 .037	919 911 900 900	.590 49.3 9968 69	£	.997	.889 .505 .351 .214	.195 .061 .039	026 015 015 010
	.20 52.5 9	2	98. 98.	586 261 139 139	037 921 971 909	907 905 903 903	27. 25. 88. 88.	£	. 995 . 951	673 415 295 146	.036 .039 .014	967 904 904 994
	.10 .5.0 . 0 %	£	99, 139, 191,	216 216 145 068	225 210 200 200 200 400	.002 .002 .002 .001	55.0	£	949 476 736 113	.355 .222 .1169 .070	.026 .018 .010	.003 .902 .902 .902
	£ . 8	2	.937 .883 .662	252 152 101 101 046	0.00 0.00 0.00 0.00 0.00 0.00	.002 .002 .001 .001	26.33 26.33 28	£:	993 869 869 876	.256 .155 .103 .007	.012 .007 .003	902 902 901 901
	5.55 2.55 8.15	£	. 990 . 799 . 536	108 108 170 170 1032	.003 .003 .003	901	57.5 57.5 116	E:	361 361 361	18 109 071 532 018	.008 .003 .003	901
	.020 67.8 9	2	. 988 . 469 . 251	.071 .026 .012	962	.901	523 53.8 13.8	É,	98 1 2 2 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	940 940 926 912	961 961 971	.001
	63.4	£	. 253 . 259 . 134 . 073	.013 .012 .015 .005	001		E de Contraction de C	5	281 251 277 177	032 018 012 012 005	.001 .001	
	.007 64.17	£	.534 .184 .097	923	.001 100 100		F 44 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	ħ.	524 177 043	922 912 909 004	.001 .001	
	.005 65.9	¥,	. 131 . 131 . 061	900 900 900 900 100	.001		SOF FA	u.	124 124 053 033	015 003 005 005 001	.901 .901	
	.002 66,2	2	150 150 322	.003 .003 .001 .001			60 50 50 50 50 50 50 50 50 50 50 50 50 50	f l	169 046 371 312	.003 .003 .002 .003		
5	190. E. I.	£	.090 .023 .010	.003 100.			9.17 71.00	Ľ)	.021 .021 .039	.032 .01		
3829	A LA SE	Ħ	12 10 0 12 12 0	8 8 8 8 E	125 150 200 250 300	350 450 500 600 600		g,	25 55 52 55	60 CB	156 156 230 250 250	350 450 450 500 600

39P0

		Grou	ind-burst		Air-burst	
39.6 39.6 137	e e		993		806. 806. 806. 806. 806.	. 838 . 764 . 689 . 619 . 896
50.00 39.0 1378	8 8		999 999 999 969 915 818	. 585 . 585 . 585 . 585 . 585 . 665 . 665	999. 2999. 2799. 8699.	£ 25 55
20.00 5 39.0 1374	2		799. 799. 799. 799. 799. 799. 799.	20.00 39.0 39.0 39.0 137.4 197.4 197.4	799. 999. 179. 179. 179.	F2 45
19.00 2 39.0 1374	È £		86. 7.25. 7.25. 7.25.	22. 22. 22. 22. 22. 23. 24. 24. 24. 24. 24. 24. 24. 24. 24. 24	9999 9995 9970 970 970 973 973	25 8 4 F.
7.000 1 39.0	3 3		2	. 137. 137. 137. 137. 137. 137. 137. 137.	96.6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	82 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5
39.0 39.0 1374			# 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	223 223 1162 1162 1174 1174 1174 1174 1174 1174 1174 117	992 992 993 193 193 194 195	300 200 196 1162
2.000 5 39.0 1374	£ £		## # # # # # # # # # # # # # # # # # #	2,000 5 39.0 138. 138. 138. 138. 138. 138. 138. 138.	\$956. \$966. \$70 \$127. \$115. \$115.	178 113 103 103 103 103 103 103 103 103 103
1,000 2 39,0 1374	2 E		25 25 25 25 25 25 25 25 25 25 25 25 25 2	.007 .055 .055 .058 .038 .038 .038 .038 .038 .038	88. 88. 88. 88. 1111. 1111.	117
.700 1. 39.0			996 982 982 983 983 983 983 1115	.053 .053 .053 .053 .030 .030 .030 .030	998 991 991 981 981 981 981 981 981 981	959 749 749 859
	1 E		996 937 756 564 564 136 136 131	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	997 993 993 593 593 117 117 117 101	076 058 087 078 078
8. 8. 5. 5. 4. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5.	2 E	86	######################################	20.00 20.00	8 18 18 18 18 18 18 18 18 18 18 18 18 18	932 932 926
39.0 3 1374 1	\$ £	8. E	930 670 670 125 117 1125 673 673	.005 .005 .005 .006 .008 .008 .008 .008 .008 .008 .008	999 799 1169 1169 117 119 119 119 119 119 119 119	.027 .029 .029 .013
137.0	\$ £		73.8 5.5 5.5 5.5 7.1 7.1 7.1 7.1 7.1 7.1 7.1 7.1 7.1 7.1	.019 .012 .010 .010 .007 .07 .03 .08 .03 .03 .03 .03 .03 .03 .03 .03 .03 .03	. 205 . 205 . 366 	.021 .015 .019
.05 39.0 1374	2 E	5 5 8	282 285 285 285 285 295 295 295 295 295 295 295 295 295 29	.015 .009 .009 .005 .005 .77 .77 .77 .77		010 010 000
39.0		.997 .986	653 1641 1641 1641 1641 1641 1641 1641 164	.006 .006 .009 .009 .009 .003 .003 .003 .003 .003	.097 .097 .098 .098 .098 .028 .018	979 707 906 800 800
010. 19.0 13.0	e 5	986 906 765		.005 .003 .003 .003 .003 .002 .016 .016 .016 .016 .016 .016 .016 .016	.993 .790 .790 .750 .750 .750 .750 .750 .750 .750 .75	989
39.0 1374		£ 98.	050	.003 .003 .003 .003 .001 .001 .001 .137* .137*	2778 2778 2778 2778 2778 2778 2778 2778	200 200 200 200 200 200 200 200 200 200
39.05 37.51 0		989 786 786 118	358 223 150 150 070 070 070 018 018	.003 .002 .002 .002 .001 .001 .001 .002 .001 .003 .003 .003 .003 .003 .003 .003	.999 .967 .967 .987 .987 .028 .011 .011	96.99
39.0	18	5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	717 1129 1085 1085 1078 1078 1078 108 108 108	2002 2003 2001 2003 39.0 39.0 137 137	2356 2511 2511 2511 2511 2511 2511 2511 25	991 991 991
50,6	1 E	5 5 5 4	005 005 005 006 000 000	.001 .001 .001 .001 .71 .73 .73	23.1.1.2.2.1.2.2.2.2.2.2.2.2.2.2.2.2.2.2	26.00 10.00
39P0 KT .(Ad.) WE 3(Pai. 13)	1 6	0 2 2 2 2	36 100 1125 1125 1250 250 250 250 250	28 29 29 52 28 48 48 48 48 48 48 48 48 48 48 48 48 48	0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	18 18 18 18 18 18 18 18 18 18 18 18 18 1

39P9

	Ground-burst		Air-burst				
35.6 35.6 0 0		.901 .903 .715 .593 .593 .593 .56 .73 .940	E 55.5.	2 = 2 5 5 5			
	FFFF		5.65.65.65.65.65.65.65.65.65.65.65.65.65	797 797 726 657 657			
			e 75.	P. 2 . 4 . 4 . 4 . 4 . 4 . 4 . 4 . 4 . 4			
10.00 *1.1 2030 0 260			B 86 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	280 280 280 191 191 139			
7,800 2504 2504 215	25 25 25 25 25 25 25 25 25 25 25 25 25 2	bence ceres	B 86.8 11.8 12.8 12.8 12.8 12.8 12.8 12.8 12	201 201 163 135 96			
3054			E	114 114 116 -095			
2,000 46,5 5831 5831			8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	F 8 9 9 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5			
1.000 1.000	2 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5		e be kreit kires	926			
50.2	996. 998. 998. 908. 908. 908. 908. 908. 908		E	923 -017 -014 -011			
5. 15. 15. 15. 15. 15. 15. 15. 15. 15. 1	* * * * * * * * * * * * * * * * * * *	210. 110. 2005. 2005. 2005. 4.1. 22.	G 86.6. FB 66.8. FT 41.6. 68.7.	015 012 003 003			
S. S.	255 175 175 175 175 175 175 175 175 175 1	23 23 31 31 31 31 31 31 31 31 31 31 31 31 31	u piet 38 25 25 10 10 10 10 10 10 10 10 10 10 10 10 10	903			
51.75 o z 1	99. 207. 208. 209. 209. 209. 209. 209. 209. 209. 209		5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	902			
6.8 0.0	. 193 . 193	***** ***	6 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	901 901 901 901			
82 52	. 115 . 118 . 182 . 182 . 182 . 183 . 183		2 113 2 113	100			
63.1	. 117 . 117 . 117 . 117 . 117 . 103 . 103 . 103 . 103 . 103 . 103 . 103 . 103 . 103 . 103		9893 988	,			
6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6	573 574 577 500 500 500 500 500 500 500 500 500	பன் சும	2 18. 18. 18. 18. 18. 18. 18. 18. 18. 18.				
790. 6	14.3 14.3 14.3 16.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0	B. 60. B. 10.	5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5				
20 mg	0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000	10 to 10 to 10	z % 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6				
2002 711.5 0	.003 .003 .003 .003 .002 .002 .002	7.00 7.10 7. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5.					
24. 2. E	.0065 .000 .000 .0001	20 % 10 %	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2				
	20 25 25 25 25 25 25 25 25 25 25 25 25 25	250 250 150 150 150 150 150 150 150 150 150 1	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	350 400 450 500 600			

3366

	Ground-burst						Air-burst						
70.00 37.3 1010 6	£		999 999 200 200 200 200 200 200 200 200	25. 25. 25. 25. 25.	77.93 37.3 31.7 645	5			8 8 E	. 826 . 759 . 692 . 570			
50,00 7 38,0 1137 9 555	£		99. 975 193.	287 288 288 288 288	38.0 38.0 1137 277 587	£			997 982 946 946	215 2736 660 882 783			
20.00 *0.0 16*8 0	2	8 66	97.9 94.6 71.0 888	23.45	19.00 194.0 194.0 190.0 377.0	£		86.	8.64 £ £	E			
10.00 2285 2285 250	£	993 992 985	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	233 233 190 157	17, 99 22,95 22,95 26,7	£		6.	920 676 676 526 10	261 261 171 171 171			
7,800 27,8 209	£	88. 87. 71.	510 510 577	170 170 137 137 161 160	276.2 276.2 123 222	2		£ £ £	8 5 5 5 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	15% 15% 15% 127			
5,000 #3,8 3281 0	£	8 4 8 8	. 709 . 587 . 284 . 284	821 901 902 903 903	5,000 7 43,8 3261 107 186	£		88.8	627 627 312	176 1139 1111 1001			
2,000 EE,6 5530 109	£	26 E 25 E	395 122 122 123 123 123 123 123 123 123 123	650 639 639 632 632	2,000 45,6 5530 73	£		8 E E E E E E E E E E E E E E E E E E E	4 2 5 E 6	939			
50.2 48.9 9411 0 0 62 75	e ş	8 8 8 8 B H	216 .157 .092 .060	20. 20. 210. 210.	1.007 84.3 84.11 55	53	999	788 E.F. 266 508 456	231 168 999 2065	45. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5			
9 7 0 7	£ \$	e ereas	153 110 110 110 110 110 110 110	.016 .016 .010	50.2	B	996	2	163 117 117 108 108 108	7.10			
.500 51.3 0	er 8.	28. 6.49. 6.49. 27.2. 165	.078 .078 .029	.015 .011 .000 .007	.597 51.3 41 53	6 ?	97.	.941 .519 .295	115 -062 -030 -030	916 - 917 - 919 - 908 - 905			
54.28 5.48 0 0 11	£ \$.5	e sesine	929 917 100 110	8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	28 28	£	988 915 177	212 112 113 115 115	030 010 0110 0111	.005 .003 .003			
51.0 5.00 5.00 5.00	ĕ \$ ëë	88. 14. 14. 14. 14. 14. 14. 14. 14. 14. 14	20 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	.002 .002 .001	3.5. 22 22	£ \$	523	11.0 11.0 11.0 10.0 10.0 10.0	920	.003 .002 .003 .001			
58.5 58.5 7.1	E 28.6	28. 171. 180. 180. 180.	£26. \$ 50. £26.	.001 .001 .001	56. 13. 13.	£ \$	58E 3.58E	. 205 . 1122 . 080 . 037	903	902			
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Ground-burst

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Appendix A

JOSS PROGRAM LISTING

The state of the s

```
6.63 Set unmuse(1/3).
6.39 to part 2 if C==2(6) or [r==?[1] and u=0].
6.37 Set n=0.
6.32 Set x=q==0:1.1216=1.20=000xp[.297en];.6289301.840=000xp[1.082*n]].
6.58 to part 30.
6.58 to part 2.
6.5 no part 2.
a.7 Ivse v.p.c.t.f.zz.0.Wec.ushemasis/i) se.zec.; in core (vissill).
s.s Ser taret.
                                                                                                               $ See sasor (ff?: \frac{1}{1}) = 1 \cdot \
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8.2 De part 5.
8.3 Set p-pepul 1,1].
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       12.1 Set enjest. 3000:1].
12.2 Type " :: Distance in feet ::" if emi.
12.3 Type " :: Distance in maters ::" if e-el.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   26.7 Type "Exter 20 walves for CEP in ft:".
26.2 Bo step 22.1 for t=6(1)25.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                19.2 Set 0=4.
19.3 Be part 5 for 3et if t30.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                7 Set p=0.
7.1 Be part 8 for 1=1(1)6.
7.2 Set P=p/26.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              9 Bo stee N.
F.7 Belete part o.
9.2 Belete step o.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          H.1 Do step 1.6.
H.2 To part 1.
                                                                                                                                                                                                                                                                                                                                                                                                                                          set d".
Belore step 1.7 to long tarm marts 1,4. ::".
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    e.5 = Bo pert 16. [for lesseaux distribution of points in a chicle).
a.51 Set remain[8.99990].
a.52 Set remain[8.99990].
a.53 Set remain[8.99990].
                                                                                                                                                             1.22 Semand | sa vWLTs | 1".
1.22 Semand | sa vWLTs | 1".
1.22 Semand | sa vWLTs | 1".
1.23 Semand | sa vWLTs | 0".
1.24 Semand | sa vWLTs | 0".
1.25 Semand | sa vWLTs | 0".
1.26 Semand | sa vWLTs | 0.00 semand | 0".
1.27 Semand | sa vWLTs | 0.00 semand | 1".
1.28 Semand | 1".
1.29 Select step | 1".5 step | 1.5.
1.6 Se step 9.2 for o"1.2,1.25,1.99,11.1,1.6.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            1.1 5cc a.f20/m = (1/3) 42/18.
3.3 5cc a.t.
3.5 5cc twit.
3.5 5cc twit.
3.5 5cc twit.
3.5 5cc twit.
3.6 7cc twit.
3.7 5cc a.t. if 18/f-11>.201.
3.7 5cc a.t. if 18/f-11>.201.
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2.00 Sec 17.0.
2.10 Sec 17.0.
2.10 Sec 17.0.
2.10 Sec 17.0.
2.11 So stop 7 (or B=0.31,5.32.
2.12 So stop 7 (or B=0.31,5.32.
2.13 Sec 17.0.
2.13 Sec 17.0.
2.14 Sec 17.0.
2.15 Sec 17.0.
2.15 Sec 17.0.
2.16 Sec 17.0.
2.17 Sec 17.0.
2.18 Sec 17.0.
2.18 Sec 18.0.
2.18 Sec 18
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     line if Y=0.
Type form 1 if Scs2 or fp[1/40]=8.
Set C=c/e.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          2.2 Set tempore (1/3).
2.4 Set 0-0.
2.4 Set 0-0.
2.4 Set 0-0.
2.4 Set 8(1):15-6.
2.5 Set 8(3,6):40.
2.5 Set 8(3,6):40.
2.5 Set 8(3,6):40.
2.5 Set 8(4,6):40.
2.5 Set 8(4,6):40.
2.5 Set 8(4,6):40.
2.5 Set 8(4,6):40.
                          1.7 Line.
1.2 50 stor 1.96 for 0=3(1) f3.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               1.8 50 sert 4.
1.4 To ruce 1.
1.94 Type form 0.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                56
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21.1 Type "Erter 26 ealuss for Tield in KT:". 21.2 Bo step 22.2 for tw1(1) 26.

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Porm s:
This is Tode 1. For fode 2 see S-11ts. (Batm items are store(1) and store(2)).
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                To loop: Delate step 1.7.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           We Ser.Pe
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    Pore 10:
Parts 37,38 apdated 11/75. Bestits may wanty slickally from F-1166.
                                                                                                                                                                                                                                                                                                                                                                            2.2.2 Lev sampling (19.70) 1.
2.2.2 Lev cant (19.70) 1.
2.2.2 Lev cant (19.70) 1.
2.2.3 Lev cant (19.70) 1.
2.3.3 Lev cant (19.70) 1.
2.3.3 Lev cant (19.70) 1.
2.3.3 Lev cant (19.70) 1.
2.3 Lev cant (19.70) 1.
2.5 Section (19.70) 1.
2.5 Sec
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                2
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WE m Weapon radius PD = Probability of Gamage
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     form 9:
To only this prearble start with: Do part 11.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   To switch to meters and vice werse: To part 12.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                $11 GOM
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                ĩ
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Entry for WH = 2107 is VM.TR = 21,17
80.5 year.
80.6 Delete B,all formalss,all forms.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              PFE: Tet
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Value Manhor de VALTE
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adjve zleli
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202 = 1962
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 FOER 11:
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     ja. 170 seng 10.7 hf "st."
ja. 20: Erd vol 11-100...to.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              37.1 Ser het.
37.1 See out ecte; 170-45.3 e., pedgmewist. miszadi. To. quaitemet.
37.2 See out ecte; 170-45.3 e., pedgmewist. miszadi. UD-4513. het. 98 Banewik 3.
37.3 See out ecte; 25-ected 170-656 mere (-2. 437); when elling it 1926 + 3867 e. glasseer 3.
37.7 Erne.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         13.52 (ex. Bef world.516 h.s. bing.Babbeward.22 execution of the control of the c
                                                                                                                                                                                                                              30 type "Inte account burst type "6.5 "o step 6.5." other as "10.".
                                                                                                                                                                                                                                                                                                                                                                            30.03 Nepe and common verse type 'e.a' o seep o... or 30.03 Belee E. 30.00 seep o... or 3
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    an on menall arrest from file additional and the sound of the sound of
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40.2 Dolone 5.
40.24 Becall Bonth 2 for file 19830.83462.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    Cope Town to Com (Tage "Sgab.).
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                #G.34 Do Step #0.12.
#9.34 Line.
25.1 Do oten 60.2 for ref0.
          22.7 Demend E(t).
22.2 Demend P(t).
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   No. 1 Ser CHESSIA.
16.2 Do part h.
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Appendix B SUMMARY OF JOSS LANGUAGE

		Done	Terminates execution of current Do for current iteration.
	IOCC	dets	Terminates execution of current Do for all iterations.
	JOSS	Cancel	Terminatus execution of all Do's.
	,	(Cancel.)	Terminates execution of last (Do).
	RAND COMPUTATION CENTER 1700 MAIN STREET	Te	Alters step-by-step sequencing. Continues at indicated part or step. To step 3.5.
	SANTA MONICA, CA 90406 393-0411 EXT. 403	Stop	Suspends step-by-step execution to await instructions from user.
Set	VERHS Assigns a value. Set may be omitted on direct commands.	Ço,	Continues execution after interrupt (pressing the interrupt key on terminal), error message, or Stop command.
	Set $x = 3$. Set $a(5,x) = y + 3az - xaa2$.	End	Terminates session by logging user off from JOSS, WYLBUR and MILTEN.
Let	Defines a formula of up to ten	liced	Types page heading on next line.
	parameters. Let $f(x,y) = x^{a+2} + 10^{a}x - 6^{a}y$. Let $h = (b - a)/2$.	Page	Advances paper to next page and types page heading on next line.
	Let $D(f,x) = [f(x+d) - f(x)]/d$.	Line	Types a blank line.
Туре	Indicates a sparse array. Let A be sparse. Types quoted text, blank lines (_),	Form	Identifies (by an integer) and stores the form typed on the next input line. Form 3: x = y = z =
	<pre>values, parts, steps, etc. Type "The quick brown fox". Type x+J, D(sin,0), _, all steps. Type all.</pre>	Reset	Reinitializes value of timer or cpu to zero. Reset timer. Reset cpu.
Demand	Types identification and equals sign, then waits for user to input value. Slank input lines are treated as		MODIFIERS
	interruptions. Demand a(3,1). Demand t as "Temperature".	if	Modifies any command. JOSS carries out the command if condition holds. Type x if 0<=x<5.
File	Stores an item* in the user's file. File part J, x, z as testdata. File all replacing inverter.	for	Set y=3 if x<=10 and x*y=10. Modifies Do only. JOSS executes part or step repeatedly for specified set of values.
Recall	Retrieves an item# from library or a private file##. Recall database(27).		Do part 3 for x=1(1)10(10)100,1000. Do step 1.2 for x=.01, .03, .1(a)b.
	Recall blackjac from library. Recall plot from file M1234.A9876.	times	Modifies Do only. JOSS executes part or step specified number of times. Do part 4, 43 times.
Discard	Erases an item* from the user's file. Discard olddata.		Do step 7.3, n+1 times.
Show	Produces a list of items in library or private file**.	in form	Hodifies Type only. JOSS types values in fields of specified form. Type x, y, z**2 in form 3.
	Show items in library. Show items in rile M1234.A9876.	sparse	Modifies JUSS' treatment of missing array elements. JUSS treats them as zeros and they require no storage. Let A be sparse.
Delete	Erases values, pa.ts, steps, forms, formulas. Delete x, part 3, all forms.		NOUNS
	Delete all values. Delete all.	time	Time of day at Computation Center. Type time.
De	Initiates execution of a step or part (step by step, beginning at the first step of part), repeatedly if modified by a for or a times phrase. Do part 6 for x=.1,2(2)10, 100*a*b.	users	Number of terminals being serviced by JOSS at the moment. Type users.
(Do)	Interprets direct Do as a stored Do (i.e., does not cancel before execution), but returns to user when	size	Number of storage units currently occupied by user's program and data; shout 1550 are available.
	done. (Do part 3.)	timer	Time in minutes and hundredths since logon or last Reset timer command.
beginning w	was are 1-d letters and/or digits, with a letter. Names may be followed watured index in the range [-250,250].	сри	Processor time in seconds and hundredths since logon or last Reset cpu command.
** File nam	ses consist of user number and sparated by ".A", e.g. M1234.A9876.	\$	Number of lines remaining on the page or screen.

FUNCTIONS

MATHEMATICAL:

eqrt(x) square root, x = 0

cin(x) x in radiane, x 100

cos(x) x in radians, x

log(x) natural log, x > 0

exp(x) e^X , exp(1) = e

AFE(X.Y) central angle, in radians, from positive x axis to the point (x,y). arg(0,0)=0, arq(-1,0)= pi.

STATEMENT FORMAT

Step Number Verb Arguments Modifium

1.23 Type x,y,z+3 in form 3 if x+y>10. 1.4 PARE 6 for x = 1(1)100, 500.

VOCABLI ARY

DIRECT

Step number not present: command is COMMAND:

executed immediately.

STOREL COMMAND:

Step number present; command is

stored in order of step number.

STEP:

A stored command; step number is limited to 9-digit number of.

PART:

A group of steps whose step numbers

have the same integer part.

FORM:

A pictorial specification of literal information and fields to be filled with values, used for formatted output. Fields are indicated by strings of underscores (with an optional decimal point) or strings of periods (for a tabular form of

scientific notation).

NUMBERS:

Limited to 9 significant digits:

10⁻⁶³ = value = 9,99999199#10⁶³

or value = J

SYMBOLS:

Single-letter identifiers, upper or lower case. May identify decimal values, logical values (true, false),

formulas, and arrays of values.

FORMULAS:

May have up to 10 formal parameters (distinct letters) or none (see Let,

under Verbs).

ARRAYS:

May have up to 10 integer-valued indices in the range [-250, 250].

ARITHMETIC: Addition (+), subtraction (~) multiplication (*), division (/), exponentiation (**), and square root (sqrt) give true results rounded to 9

significant digits. Zero is substituted on underflow.

RELATIONS:

allowed; e.g., a b =c).

LOGIC:

and or not

GROUPERS:

() [] used interchangeably, in

pairs.

IMPLIED

GROUPINGS: 3+1/2+1/4*5 = [3+(1/2)]+[(1/4)*5]

 $-2**3*4-5 = [-(2^3)*4]-5$

2**3**4 = (2³)4

a or b and not c or d = a or [b and (not c)] or d

NUMBER DISSECTION:

sen(x) signum (or sign) -1 if x = 0if x = 0 - 0 = +1 11 x · 0

10(x) integer part ip(100.5) = 100

fp(x) fp(100.5) = .5fractional part dp(x) dp(190.5) = 1.005disit part

up(x) exponent part xp(100.5) = 2absolute value

0 if x=false . 1 if xetrue = 1 if x=true

for numeric values

tv(x) translation value

- 0 if x=false - false if x=0 w true if x wo

ITERATIVE:

sum[1=a(b)c: f(1)]

sum[x, y, z+10]

prod(i=a(b)c: f(1)] min(i=s(b)c: f(1))

prod[x, y, z+10] min[x, y, z+10]

aax[i=a(b)c: f(i)]

max[x, y, z+10]

conj[x:y:=z, y:3, P]

confide(b)c: P(i)1 disj[i=a(b)c: P(i)]

disj[x-y-=2, y-3, P]

first(i=a(b)c: P(t)i

gives first value of i for which P(i) is true

RULES OF FORM

One command per line, one line per command. Each input line must be ended by pressing the

Return key.

Before you type anything, make sure that JoSS is ready to receive input. It will indicate this by typing an underscore and, it available, ringin. the bell.

Lines can be corrected by backspacing and retyping before pressing Return. Lines that begin or end with an asterisk, or end with an interrupt, arignared.

Words and numerals may neither abut nor contain embedded spaces; spaces may not appear between an identifier (or any array, a formula, or a function) and its associated lett grouper; otherwise, spaces may be used freely.

Except for the step number at the beginning of a stored command, anywhere a number may or used, an equivalent expression may also be used.

The not sign as used in "not equal" (=) may appear as a backslash or a tilde on some terminals. The underscore may appear as a left-pointing arrow.